

New record of *Gonatopus flavoniger* Olmi, 1991 (Hymenoptera: Dryinidae) from Paraná, Brazil, with notes on some aspects of its biology and morphology

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Abstract

Gonatopus flavoniger Olmi, 1991, is newly recorded from state of Paraná, Brazil. This record is based on a female specimen reared from a nymph of a leafhopper (Cicadellidae, Deltocephalinae, Athysanini), and one additional female collected by sweeping from the same locality. The species is illustrated and characterized morphologically. Some aspects of its biology are treated: host identification and the location of the dryinid larva in the host, the construction of the cocoon, and duration of pupa phase until emergence of the adult.

Key words

Aculeate wasps; Gonatopodinae; group-seven; Neotropical Region; taxonomy.

Academic editor: Joe MacGown | Received 19 February 2017 | Accepted 24 April 2017 | Published 12 July 2017

Citation: Martins AL, Domahovski AC (2017) New record of *Gonatopus flavoniger* Olmi, 1991 (Hymenoptera: Dryinidae) from Paraná, Brazil, with notes on some aspects of its biology and morphology. Check List 13 (4): 95–99. <https://doi.org/10.15560/13.4.95>

Introduction

The Dryinidae Haliday, 1833 (Hymenoptera, Chrysidoidea) are cosmopolitan wasps, parasitoids and predators of leafhoppers (Hemiptera, Auchenorrhyncha) Olmi and Virla (2014). Currently, Dryinidae has about 1,800 known species distributed in 50 genera and 16 subfamilies (Olmi et al. 2015, Martins et al. 2015a, 2015b, Tribull 2015). Approximately 500 species in 24 genera and eight subfamilies are known from the Neotropical region, and, approximately 150 species in 16 genera and six subfamilies are recorded from Brazil (Olmi and Virla 2014, Martins et al. 2015a, 2015b). The Dryinidae in Brazil has been studied mainly by Olmi (1984, 1991, 2011), Coelho et al. (2011), Martins (2013), Olmi and Virla

(2014), Versuti et al. (2014), Martins (2015), Martins et al. (2015a, 2015b), and Martins and Krinski (2016).

Among the subfamilies of Dryinidae, Gonatopodinae Kieffer in Kieffer & Marshall (1906) 11 genera have been recorded from the Neotropical region and three from Brazil (Olmi and Virla 2014). *Gonatopus* Ljungh, 1810 is the most diverse genus of Gonatopodinae with about 440 species described worldwide, including 120 from the Neotropical region and 32 from Brazil (Olmi and Virla 2014, Martins et al. 2015a, 2015b). This genus comprises 12 groups of species: 9 groups for the Neotropical region and 5 for Brazil. “Group-seven” is the most diverse group and comprises 61 Neotropical species (Olmi and Virla 2014). *Gonatopus flavoniger* Olmi, 1991, belongs to this group. It was described from Serra da Bocaina, state of São

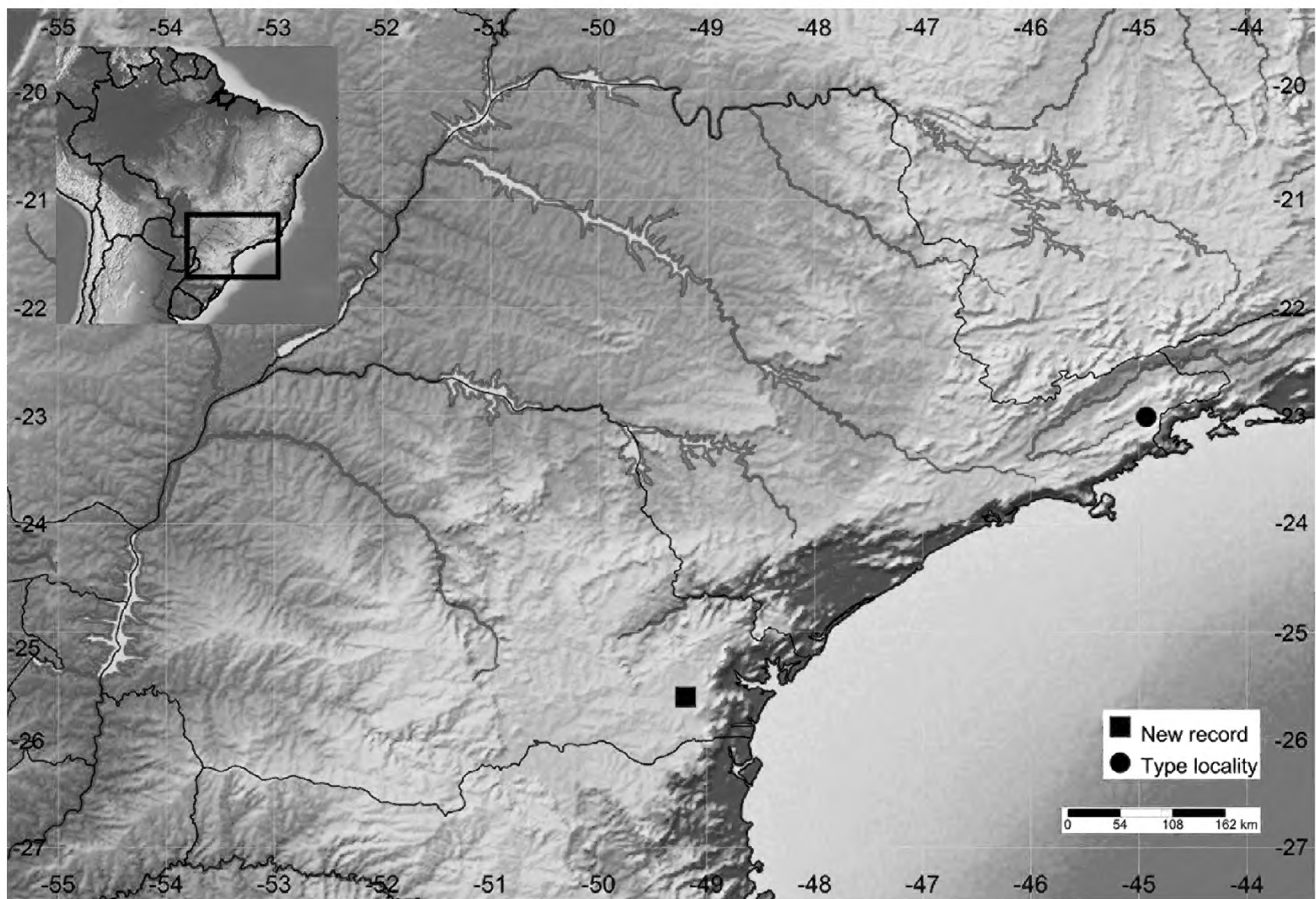


Figure 1. Map showing the distribution of *Gonatopus flavoniger*. The circle representing the type locality at São Paulo and the square the new register at Paraná States, Brazil.

Paulo, by Massimo Olmi (1991) based on a single female specimen. However, the unique structure illustrated in the original description was the chela.

Gonatopus are associated to the following families of leafhoppers and planthoppers (Hemiptera, Auchenorrhyncha): Acanaloniidae, Caliscelidae, Cicadellidae, Cixiidae, Delphacidae, Dictyopharidae, Flatidae, Issidae, Lophopidae, Meenoplidae and Tropiduchidae (Guglielmino et al. 2013, Olmi and Virla 2014). The only published account of *Gonatopus* species from Brazil associated with hosts is for *G. flavipes* Olmi, 1984 (Meneses et al. 2013). Here we report the collections of 2 specimens of *G. flavoniger* from the state of Paraná, Brazil: one collected in 2016 and the other in 2017. This new record provided us with the opportunity to study some aspects of the biology of *G. flavoniger*, identify its host, and better characterize it.

Methods

The studied specimen emerged from a parasitized nymph of a leafhopper collected by one of the authors (ACD) by sweeping in São José dos Pinhais (25°36'18" S, 049°11'37" W) (Fig. 1), state of Paraná, Brazil, on 27 August 2016. After its collection, the parasitized specimen (Figs. 2, 3) was reared on grass, *Bromus catharticus* Vahl in a test tube for 3 days. The mature larva entered pupal phase on a graminea leaf present inside the test tube on 30 August 2016 (Fig. 4). To identify the host leaf hop-

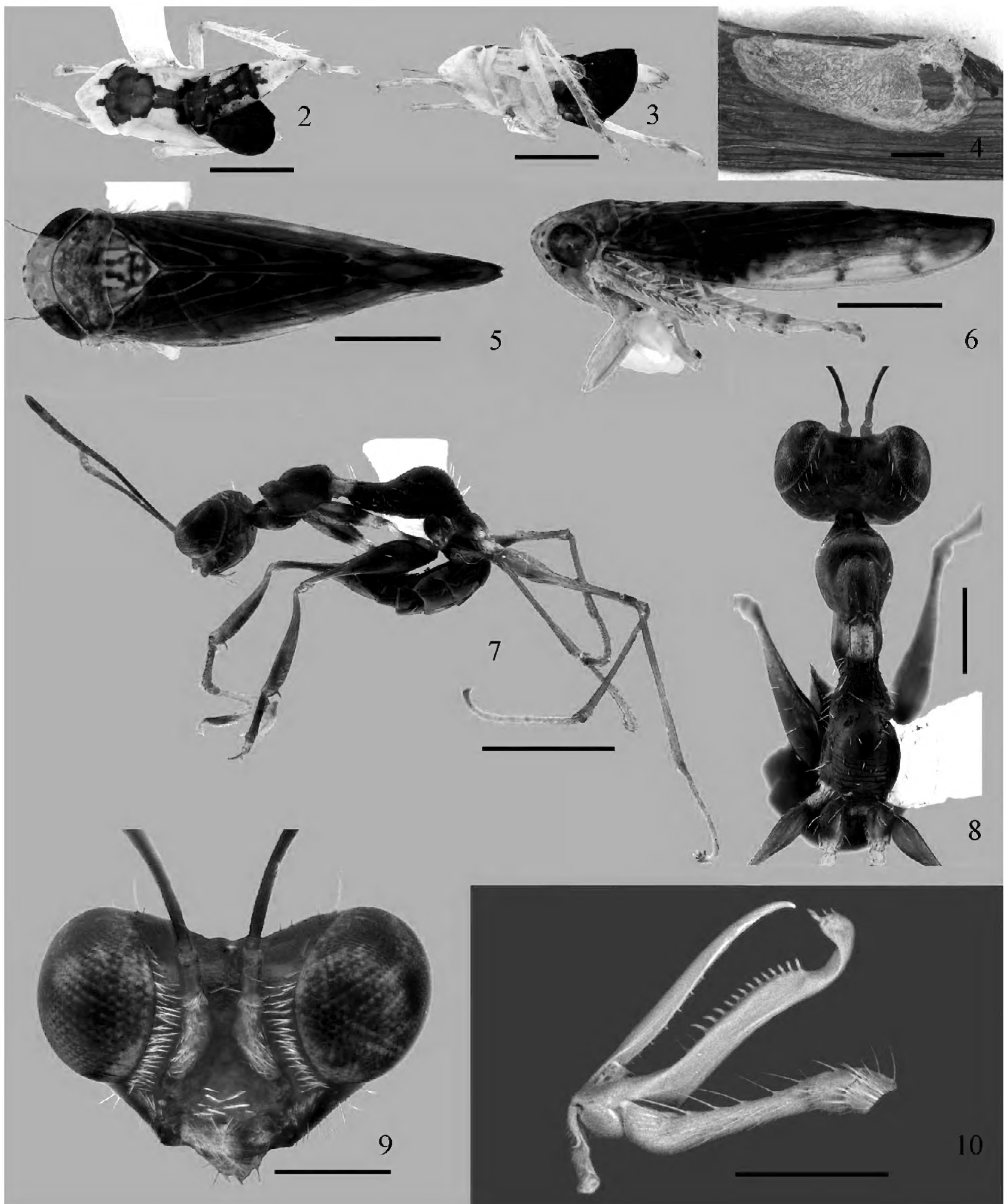
per, a non-parasitized nymph was collected and reared to the adult stage and found to be in the Deltocephalinae subfamily (Figs. 5, 6). The leafhopper was dissected and images of habitus and male genitalia were sent to taxonomic specialists of this subfamily for identification. A dryinid female emerged 53 days after pupation (Fig. 7). The specimen was carried to the Laboratório de Biologia Comparada de Hymenoptera, Departamento de Zoologia, Universidade Federal do Paraná (UFPR).

Observations and identifications were made using a Leica M125 stereomicroscope. The morphological terminology and keys are those proposed by Olmi and Virla (2014). Color images were obtained using a LEICA DFC295 digital camera attached to the stereoscopic microscope and processed with Zerene Stacker software (1.04 version build). Scanning electron photomicrographs (SEMs), were made in the Center of Electron Microscopy of Universidade Federal do Paraná. Figures were prepared using Adobe Photoshop (version 11.0). The specimens are deposited in the Entomological Collection Padre Jesus Santiago Moure, Department of Zoology, Federal University of Paraná (DZUP).

Results

***Gonatopus flavoniger* Olmi, 1991: Figures 8–10**

Gonatopus flavoniger Olmi 1991: 349 (female, holotype from São Paulo, Serra da Bocaina, III.1973, not examined).



Figures. 2–10. 2, 3. Parasitized nymph of leafhopper in dorsal (2) and lateral (3) view. 4. Dryinid cocoon on graminea leaf. 5, 6. Adult of Deltocephalinae host in dorsal (5) and lateral (6) view. 7–10. *Gonatopus flavoniger*. 7, habitus, lateral view. 8, head and mesosoma in dorsal view. 9, head, in frontal view. 10, chela in lateral view. Scale bars: 2–7 = 1.0 mm, 8 = 0.5 mm, 9 = 0.25 mm, 10 = 50 μ m.

Material examined. One female: Brazil: Paraná, São José dos Pinhais, 25°36'18" S, 049°11'37" W, 880 m elev., scanning network, parasitized leafhopper collected on 27.viii.2016, mature larva entered in pupal phase on 30.viii.2016, dryinid adult emergence on 22.x.2016, A.C. Domahovski leg. (voucher number DZUP 027504). One further female specimen collected on 04.i.2017 by sweeping in the same locality and by the same collector was

studied (voucher number DZUP 027504). The voucher numbers of hosts parasitized leafhopper (DZUP 083013) and another not parasitized nymphs was collected and reared until the emergence of the adult leafhopper (DZUP 083012).

Diagnosis. Female. Length 3.2 mm (Fig. 7). Head black, except mandible, clypeus and anterior region of face testaceous and occiput brown-testaceous (Figs 8, 9);

antenna testaceous except segment 3 brown; prothorax testaceous, with some black spots; rest of mesosoma black; metasoma black; legs testaceous, except meso and metacoxa and club of metafemur darkened. Antenna clavate; antennal segments in following proportions: 10:6:18:10:8.8:7:7:8:6:9. Head slightly excavated, shiny, granulated (Fig. 8); frontal line incomplete, absent near clypeus; occipital carina absent; POL= 2; OL= 2; OOL= 10. Pronotum shiny, slightly granulated, crossed by strong transverse impression (Figs. 7, 8). Scutum with 2 lateral pointed apophyses (Fig. 8). Metanotum granulated, rugose. Propodeum rugose, transversely striate (Fig. 8). Meso-metapleural suture obsolete (Fig. 7). Protarsal segments in following proportions: 15:3:5:20:26. Enlarged claw (Fig. 10) with 1 small subapical tooth and one row of 6 bristles. Segment 5 of protarsus with one row of five bristles and 13 lamellae; distal apex with about 15 lamellae. Tibial spurs 1/0/1.

Hosts. Cicadellidae, Deltocephalinae, Athysanini, *Atanus* sp.

Discussion

There are few studies about the biology of *Gonatopus* species and of the 32 species of *Gonatopus* reported from Brazil, only *G. flavipes* has data about its biology (Meneses et al. 2013, Olmi and Virla 2014, Martins et al. 2015a, 2015b). Here with *G. flavoniger* we present a second study of biology of a *Gonatopus* species. Further studies on biology are needed to evaluate the population fluctuation of this parasitoid in different habitats. Also required is an evaluation of whether there is a specificity of *Gonatopus* species with their hosts or if they can parasitize several families, subfamilies and genera of the leafhoppers. Based on other studies carried out with *Gonatopus* species associated with pests of economic importance (Guglielmino 2002, Mita et al. 2012, Mita and Pham 2014, Martins and Krinski 2016), *G. flavoniger* could be used for future biological control of Auchenorrhyncha.

Gonatopus flavoniger was described in Serra da Bocaina, state of São Paulo, based on a single specimen. Our new record from Paraná confirms the presence of this species in South region of Brazil. We best characterized the species based on morphological variation of the integument, and the specimens we studied differ from the original description by having the head and pronotum partially black; only the head of the holotype is brown and the incomplete front line, in the original description is completa. We also observed variation in the number of lamellae in the elongated claw and in the 5 tarsi (Olmi and Virla 2014). This shows the importance of studying and describing species based on more than 1 specimen to show variation.

Some aspects of the biology of *G. flavoniger* were observed. The larva was located near base of the leafhopper abdomen, between the fourth and fifth segments,

on the left side. This differs from specimens of other species that we observed and from available information in the literature, in which larvae may be located on the following regions: on the thorax, under the wings; near the head; on the abdomen, on the basal segments (as in the studied specimen), apical segments or also on dorsal, lateral or ventral regions of abdomen. As to the construction of the cocoon, we observed that the larva built the cocoon on grass, which differs from other dryinids that make cocoons in the soil. The cocoon is composed of 2 layers: 1 outermost layer, which is larger and probably serves as a protection; and another inner layer where development occurs. The pupal phase lasted for approximately 53 days.

Acknowledgements

We thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) for fellowships provided to A.L. Martins (CNPq Process 142415/2015-4) and A.C. Domahovski (CNPq Process 130388/2015-7). Many thanks also to the Center of Electron Microscopy of Universidade Federal do Paraná (UFPR) for the SEM photomicrographs. Many thanks to Dr. Marcoandre Savaris (UFPR) for the identification of graminean species, Msc. Beatriz M. C. de Vasconcelos (UFRJ, Brazil) and Dr. James N. Zahniser (University of Illinois, USA) for the identification of leafhopper genera, Dr. Massimo Olmi (Tropical Entomology Research Center, Viterbo, Italy) for help in the identification of the species and for the review of the manuscript, Dr. Gabriel A. R. Melo curator of the DZUP collection, and to the editor and the anonymous reviewers this paper.

Authors' Contributions

ACD collected the specimens in the field; ALM and ACD wrote the text; ALM examined the specimens and checked the identification and characterization of specie; ALM made the images; ACD and made the Maps and created the plate.

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